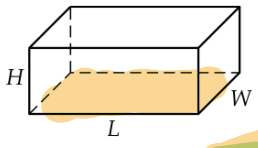
7.5 Volume

The Cylinders

Volume of a Rectangular Solid

The volume, V, of a rectangular solid with length L, width W, and height H is given by $V = LWH$.



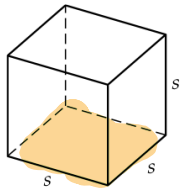
LWH

B H

area of base · height

Volume of a Cube

The volume, V, of a cube with side of length s is given by $V = s^3$.



s^3

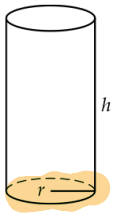
$s \cdot s \cdot s$

B H

base · height

Volume of a Right Circular Cylinder

The volume, V, of a right circular cylinder is given by $V = \pi r^2 h$, where r is the radius of the base and h is the height of the cylinder.



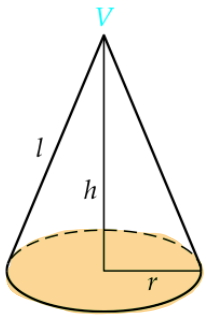
$\pi r^2 h$

base height

The Cones

Volume of a Right Circular Cone

The volume, V, of a right circular cone is given by $V = \frac{1}{3}\pi r^2 h$, where r is the length of a radius of the circular base and h is the height of the cone.

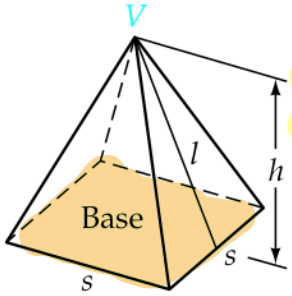


$\frac{1}{3}\pi r^2 h$

1/3 base height

Volume of a Regular Square Pyramid

The volume, V, of a regular square pyramid is given by $V = \frac{1}{3}s^2 h$, where s is the length of a side of the base and h is the height of the pyramid.

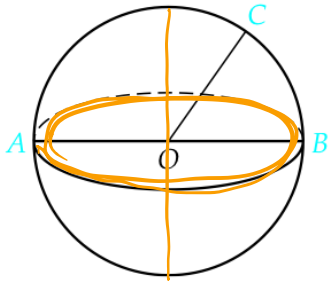


$\frac{1}{3}s^2 h$

1/3 base height

Volume of a Sphere

The volume, V, of a sphere with radius of length r is given by $V = \frac{4}{3}\pi r^3$.

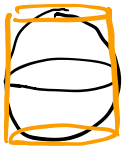


$\frac{4}{3}\pi r^3$

$2\pi r^3$

πr^2 $2r$

"base" "height"

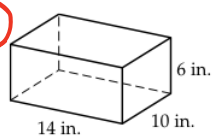


$$d = 2r \quad \text{or} \quad r = \frac{1}{2}d$$

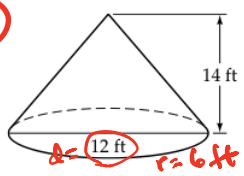
EXERCISE SET 7.5 Volume

■ In Exercises 1 to 6, find the volume of the figure. For calculations involving π, give both the exact value and an approximation to the nearest hundredth of a unit.

1.

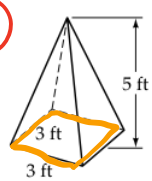


2.

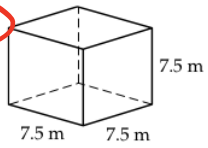


d = 12 ft r = 6 ft

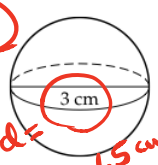
3.



4.

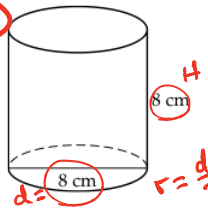


5.



d = 3 cm r = 1.5 cm

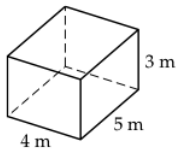
6.



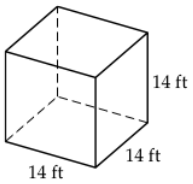
H = 8 cm d = 8 cm $r = \frac{d}{2} = \frac{8}{2} = 4$

■ In Exercises 7 to 12, find the surface area of the figure. For calculations involving π, give both the exact value and an approximation to the nearest hundredth of a unit.

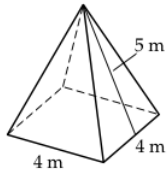
7.



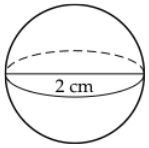
8.



9.



10.



1) $(14)(10)(6) = 840$ cu in
840 in^3

4) $7.5^3 = 421.875$ cu m
421.875 m^3

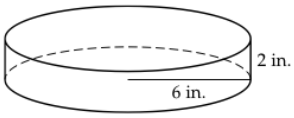
6) $\pi(4)^2 \cdot 8 = 128\pi \text{ cm}^3$ (cu cm)
area of base
exact answer
$= 402.124 \text{ cm}^3$
approximate

2) $\frac{1}{3}\pi 6^2 14 = 168\pi \text{ ft}^3$
$\frac{1}{3}$ base height
$= 527.788 \text{ ft}^3$

3) $\frac{1}{3} 3^2 5 = 15 \text{ ft}^3$
1/3 base height.

5) $4/3\ \pi\ 1.5^3 = 4.5\pi \text{ cm}^3$
$= 14.137 \text{ cm}^3$

11.



12.

■ In Exercises 13 to 45, solve.

13. Volume A rectangular solid has a length of 6.8 m, a width of 2.5 m, and a height of 2 m. Find the volume of the solid.

$V = LWH = (6.8\text{m})(2.5\text{m})(2\text{m})$
$= \boxed{34\ \text{m}^3}$

14. Volume Find the volume of a rectangular solid that has a length of 4.5 ft, a width of 3 ft, and a height of 1.5 ft.

15. Volume Find the volume of a cube whose side measures 2.5 in.

$V = s^3 = (2.5\text{in})^3 = \boxed{15.625\ \text{in}^3}$

16. Volume The length of a side of a cube is 7 cm. Find the volume of the cube.

17. Volume The diameter of a sphere is 6 ft. Find the exact volume of the sphere.

$r = 3\text{ ft}$

$V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(3\text{ft})^3 = \boxed{36\pi\ \text{ft}^3}$

18. Volume Find the volume of a sphere that has a radius of 1.2 m. Round to the nearest hundredth of a cubic meter.

19. Volume The diameter of the base of a cylinder is 24 cm. The height of the cylinder is 18 cm. Find the volume of the cylinder. Round to the nearest hundredth of a cubic centimeter.

$r = 12$

$V = \pi r^2 h = \pi(12\text{cm})^2(18\text{cm})$
$= 2592\pi\ \text{cm}^3$
$= \boxed{8143.008\ \text{cm}^3}$

20. Volume The height of a cylinder is 7.2 m. The radius of the base is 4 m. Find the exact volume of the cylinder.

21. Volume The radius of the base of a cone is 5 in. The height of the cone is 9 in. Find the exact volume of the cone.

$V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(5\text{in})^2(9\text{in})$
$= \boxed{75\pi\ \text{in}^3}$

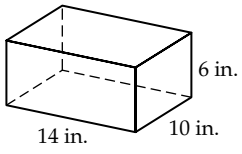
22. Volume The height of a cone is 15 cm. The diameter of the cone is 10 cm. Find the volume of the cone. Round to the nearest hundredth of a cubic centimeter.

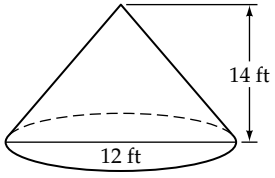
the sphere, with respect to its volume, is submerged. How much does the water level rise? Round to the nearest hundredth of an inch.

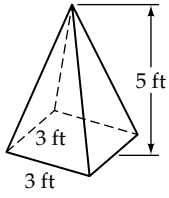
3. A chemist wants to know the density of a statue that weighs 15 lb. The statue is placed in a rectangular tank of water that is 12 in. long and 12 in. wide (see Figure 3 on page 413). The water level rises 0.42 in. Find the density of the statue. Round to the nearest hundredth of a pound per cubic inch. *Hint:* Density = weight ÷ volume.

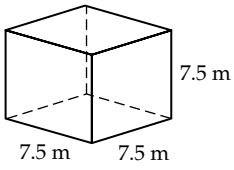
EXERCISE SET 7.5

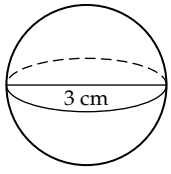
■ In Exercises 1 to 6, find the volume of the figure. For calculations involving π, give both the exact value and an approximation to the nearest hundredth of a unit.

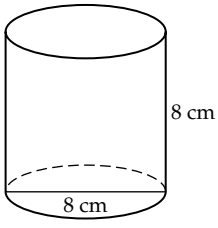
1. 

2. 

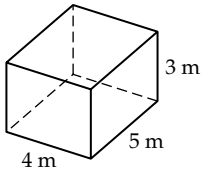
3. 

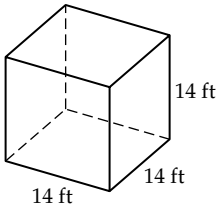
4. 

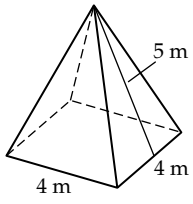
5. 

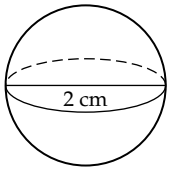
6. 

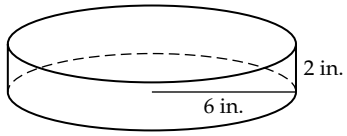
■ In Exercises 7 to 12, find the surface area of the figure. For calculations involving π, give both the exact value and an approximation to the nearest hundredth of a unit.

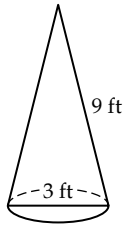
7. 

8. 

9. 

10. 

11. 

12. 

■ In Exercises 13 to 45, solve.

13. **Volume** A rectangular solid has a length of 6.8 m, a width of 2.5 m, and a height of 2 m. Find the volume of the solid.

14. **Volume** Find the volume of a rectangular solid that has a length of 4.5 ft, a width of 3 ft, and a height of 1.5 ft.

15. **Volume** Find the volume of a cube whose side measures 2.5 in.

16. **Volume** The length of a side of a cube is 7 cm. Find the volume of the cube.

17. **Volume** The diameter of a sphere is 6 ft. Find the exact volume of the sphere.

18. **Volume** Find the volume of a sphere that has a radius of 1.2 m. Round to the nearest hundredth of a cubic meter.

19. **Volume** The diameter of the base of a cylinder is 24 cm. The height of the cylinder is 18 cm. Find the volume of the cylinder. Round to the nearest hundredth of a cubic centimeter.

20. **Volume** The height of a cylinder is 7.2 m. The radius of the base is 4 m. Find the exact volume of the cylinder.

21. **Volume** The radius of the base of a cone is 5 in. The height of the cone is 9 in. Find the exact volume of the cone.

22. **Volume** The height of a cone is 15 cm. The diameter of the cone is 10 cm. Find the volume of the cone. Round to the nearest hundredth of a cubic centimeter.